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Introduction[1]

The need to find ways to boost GDP growth is particularly important in the recovery from the current recession. The implementation of structural reforms aiming at decreasing anti-competitive regulations may be one of them. The multifactor productivity (MFP) gains obtained from such reforms could improve significantly potential output growth, thereby also facilitating the adjustment of public finances, which have suffered from the crisis and the ensuing recovery plans. We document in this paper some simulations, which are based on estimates of a "neo-Shumpeterian" model and tend to show that important MFP growth gains could be obtained in developed countries by adopting best regulation practices in "upstream sectors", i.e., sectors that are chief providers of intermediate inputs to the economy.

We first describe two main channels through which the lack of competition in sectors providing intermediate inputs (henceforth upstream sectors) can affect efficiency growth in downstream sectors, by proposing an extension of the "neo-Schumpeterian" endogenous growth model of Aghion et al. (1997). We then present the econometric model we use to test the existence and estimate the importance of such upstream anti-competitive effects. Next, we describe our country-sector MFP and regulation data, and discuss our main empirical results and the related robustness checks. Finally, based on these results, we provide some illustrative simulations of the potential effects of policy reforms increasing competition in upstream markets.

Two channels

A large and growing body of research has studied the effects of competition on growth (for a survey, see Aghion and Griffith 2005). While competition can affect economic performance through various channels, this line of research has usually focused on the direct effects of a lack of competition in a sector on its productivity performance. We focus here on the effects of regulations that curb market competition in upstream sectors, such as legal barriers to entry in non-manufacturing markets, on the productivity performance of downstream sectors.

We distinguish two main channels through which lack of competition in upstream sectors can generate "trickle-down effects" that affect the productivity performance of other sectors. Firstly, anti-competitive regulations in an upstream sector can reduce competition downstream if access to downstream markets requires using intermediate inputs produced upstream, particularly in the case of services inputs where import competition is limited. For example, when financial market regulations narrow the range of available financial instruments or products, access to finance and hence new entry and firm growth in downstream sectors can be made more difficult. Secondly, even if anti-competitive upstream regulations do not restrict market access downstream, they can still curb incentives to improve efficiency in downstream sectors or firms. When markets for intermediate inputs are imperfect, downstream firms may have to negoti-

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[1] This presentation provides a short overview of the study by Bourlès et al. (2010). The illustrative simulations given here are different, however, from those of the study. The views expressed in the paper are those of the authors and do not necessarily reflect those of Banque de France, the OECD or its member countries.

ate with suppliers and can be held up by them. Regulations that increase suppliers' market power can thus reduce incentives to improve efficiency downstream, since (temporary) profits that downstream firms may expect from such improvements will have to be shared with the suppliers. These two channels are explicitly presented in a theoretical model, drawn from Lopez (2010) and also explained in Bourlès et al. (2010).

Empirical model

Our empirical analysis is based on an econometric model that directly relates country-sector productivity to regulatory burden indicators constructed on the basis of OECD indicators of non-manufacturing regulation and that interacts the effects of regulation with a gap variable of distance to the productivity technological frontier (see data section below). The model allows for persistent heterogeneity in productivity levels and growth across countries and sectors, with productivity levels and growth in follower country-sector driven by the level and growth of the productivity technology frontier. Such a model, which can be viewed as an empirical implementation of a "neo-Schumpeterian" growth framework, has been used extensively in empirical research on the determinants of productivity growth at both the firm level (e.g., Aghion et al. 2005) and industry level (Nicoletti and Scarpetta 2003; Conway et al. 2006; Griffith et al. 2006).

Our baseline model is precisely the following Error Correction Model (ECM):

$$\Delta \ln MFP_{cs,t} = \alpha_1 \Delta \ln MFP_{Fs,t} + (1-\alpha_0) gap_{cs,t-1} + \alpha_3 REG_{cs,t-1} + \alpha_4 REG_{cs,t-1} \bullet gap_{cs,t-1} + \gamma_s + \gamma_{c,t} + \varepsilon_{cs,t} \quad (1)$$

where $MFP_{c,s,t}$ is the MFP level of a non-frontier country-sector pair c,s in year t; $MFP_{F,s,t}$ is the MFP level at the technological frontier F for sector s in year t; $REG_{c,s,t}$ is the regulatory burden indicator in each country/sector/year triad;

$$gap_{cs,t} = \ln\left(\frac{MFP_{Fs,t}}{MFP_{cs,t}}\right)$$

is the country-sector distance from the sector frontier in year t; and where γ_s, $\gamma_{c,t}$ stand for respectively sector and country-year fixed effects and $\varepsilon_{c,s,t}$ is a random error term. As usual we note $\ln(X)$ the natural logarithm of variable X, and $\Delta \ln X_t = \ln Xt - \ln X_{t-1}$ the log first difference of the variable X.

Throughout our analysis, we focus on the total effects of anti-competitive upstream regulations, i.e., the expression ($\alpha_2 + \alpha_3\, gap_{c,s,t-1}$). Note that our estimates would be consistent with the neo-Schumpeterian view that lack of competition is more damaging for country-industry pairs that are close to frontier and that compete neck-and-neck with their global rivals only if $\alpha_2 < 0$ and $\alpha_3 > 0$. Note also that at the steady-state, the equilibrium distance to the technological frontier ($gap_{c,s}$) is decreasing with the difference ($\gamma_c - \gamma_F$) between the country and the frontier technical progress effects, and increasing with the difference ($REG_{c,s} - REG_{F,s}$) between the country and the frontier regulation levels (Bourlès et al. 2010).

Data

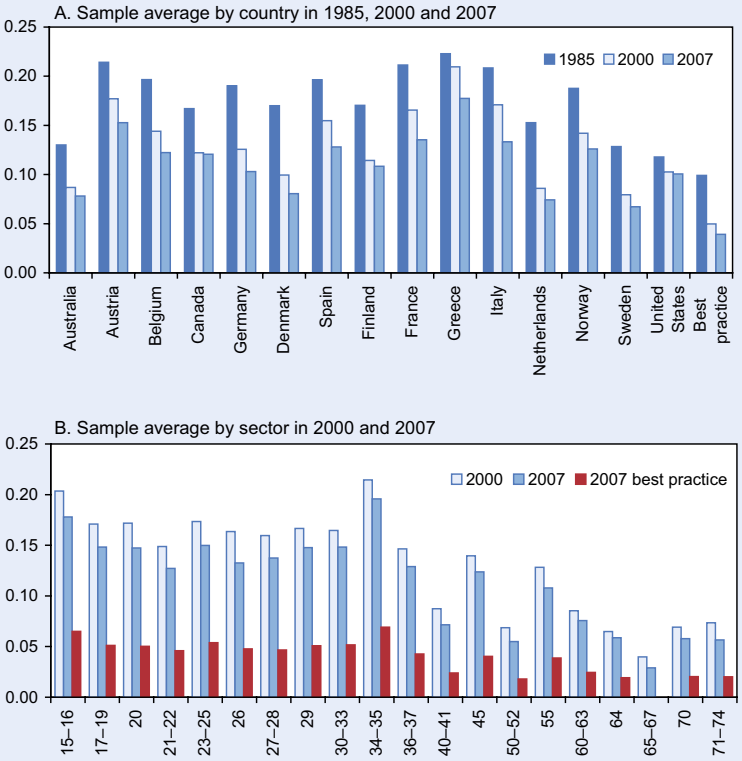
On the basis of the OECD and EUKLEMS country-sector data bases, we have assembled an unbalanced panel of 4,629 observations for 15 countries and 20 sectors over the 1984–2007 period. Empirical research on the effects of competition on productivity has used a variety of measures of competitive pressures. We rely here on regulatory burden synthetic indicators constructed on the basis of the OECD non-manufacturing regulation elementary indicators available in the OECD international product market regulation database.[2] These synthetic indicators allow taking into account the trickle down effects of competitive pressures in upstream industries on downstream industries. They have the advantage of being more or less explicitly linked to policies that affect competition, as well as that of being largely exogenous and thus minimizing potential endogeneity biases. The OECD elementary indicators of non-manufacturing regulation are themselves based on detailed information on laws, rules and market and industry settings and cover energy (gas and electricity), transport (rail, road and air) and communication (post, fixed and cellular telecommunications), retail distribution and professional services, with country and time coverage varying across industries. In addition we also use here the indicator of restrictions to competition in financial services constructed by de Serres et al. (2006).

[2] These indicators are publicly available at www.oecd.org/eco/pmr. See Bourlès et al. (2010) for details on the construction of the regulatory burden synthetic indicators, as well as for explanations on our measures of the other variables in the econometric model: country MFP and MFP country sector gap to the sector technological frontier.

Figure

VARIABILITY OF THE "REGULATORY BURDEN" INDICATORS AND "BEST PRACTICE"

0–1 scale from least to most restrictive



Sectors: 40–41: Electricity, gas and water supply; 50–52: Wholesale and retail trade, repairs; 60–63: Transport and storage; 64: Post and telecomunications; 65–67: Financial intermediation; 71–74: Renting of material and equipment and other business activity.

The Figure shows the sample average by country of the regulatory burden indicators in 1985, 2000 and 2007 as well as the 2000 and 2007 sector average, and corresponding best practice.[3] The changes over-time reflect the evolution of non-manufacturing regulation and de-regulation in the countries covered by the sample. In spite of the convergence in policies in recent years important cross-country differences remain in 2007.

Empirical results

The OLS estimates for different specifications of our empirical model are presented in Bourlès et al. (2010, Table 1).[4] The estimates are consistent with the implications of our "neo-Schumpeterian" model. MFP growth in the sector of the leader country has a positive and highly significant influence on MFP growth in the less productive sectors of other countries, indicating a sizeable rate of technological pass-through. The technology gap has also a positive and significant influence showing that countries tend to catch up in the sectors where they lag behind the leader country. Finally, as predicted, our indicator of regulatory burden is found to curb MFP growth and increasingly so, the closer MFP level is to the technological frontier. It has indeed a very significant influence due to its interaction with the MFP gap, even if it us not statistically different from zero when estimated at its mean.[5] This influence is stronger for country/sector/period triads that operate close to the technological frontier, since the interaction term coefficient is significantly positive ($\alpha_3 < 0$).

Interestingly, anti-competitive regulation in upstream sectors seems to have played an increasingly damaging role in MFP growth in the more recent period. Indeed, when we distinguish the two sub-periods 1985–94 and 1995–2007, the estimated average impact of the regulatory burden indicator, which is non significantly positive in the first sub-period, becomes significantly negative in the second sub-period. At the same time, the attenuating effect of the interaction of the regulatory burden and gap on MFP growth is more than halved.

The more negative impact of anti-competitive regulation on MFP growth in the recent period seems a robust finding which will need further investigation. It is likely to be related to two major sources of economic structural change during this period: globalization and the diffusion of ICT technologies. With increased integration of the world economy compe-

[3] In the Figure, as well as in our simulations here, best practice for the regulatory burden indicator in a given sector is constructed on the basis of the average of the three lowest values of the underlying elementary regulation indicators in the upstream sectors across countries.

[4] Our estimates are quite robust to changes in data coverage and variable definitions, as documented in Bourlès et al. 2010.

[5] The F-test of joint equality to zero of α_1, α_2 and α_{43} and that of α_2 and α_3 are very strongly rejected.

tition becomes tougher for firms in downstream sectors, and ICT adoption and the corresponding reorganization of production processes become increasingly compelling for them. Thus, the erosion of returns from efficiency improvements due to their appropriation by regulated upstream sectors is likely to be more damaging for productivity incentives, and barriers to entry in upstream sectors are likely to be increasingly reflected in a drag on sector-level productivity performance. Note that such changing effects of anti-competitive regulation are different from the ones reflecting different levels of country-sector development as captured by the MFP gap.

Results of simulation exercises

To illustrate our results and their implications, we propose a simulation of the MFP gains for 24 OECD countries under the extreme assumption they would be able to reduce their regulatory burden in the year 2010 to the level of best practice anti-competitive regulation observed in upstream sectors in 2007.

Precisely, the simulated MFP gains are computed under the following assumptions:

- we use the estimates over the 1995–2007 period of our econometric model specification (1) as reported in the last column of the Table of Bourlès et al. (2010);
- we assume that the distance to the technological frontier, for each country-sector and the level of anti-competitive regulations in upstream sectors, are the same in 2010 as the ones known in 2007; the regulatory burden indicator is computed using the country input-output tables;
- we also assume that the best practice upstream regulation indicators adopted in 2010 by the countries are defined as the average of the three lowest values observed in 2007 of the anti-competitive regulation indicators in the upstream sectors across countries.[6]

The Table shows the impacts of the simulated reforms on the average annual MFP growth over five years (i.e., for the period 2011–15 since a change in the regulatory burden is supposed to influence MFP growth in our econometric model with a one-year lag). These impacts are given separately for the manufacturing sectors, the non-manufacturing sectors (excluding the farm and mining sectors), the business sectors (i.e., manufacturing and non-manufacturing sectors together), and for the whole economy (where we assume that the reforms in upstream sectors have no impact on the non-business sectors).

The average annual MFP growth gains from adopting best practice upstream regulations are slightly different across countries. For the whole economy, the gains range from 0.2 of a point in Denmark to 1.7 points in Poland. These differences reflect in fact four underlying factors: (i) the differences in 2010

Table

Average annual MFP growth gains from reforms implemented in 2010, for the period 2011–15

in percentage points

	Manufacturing sectors (15–37)	Non-manufacturing sectors (40–74)	Business sectors* (15–74)	Whole economy** (01–99)
Australia	1.04	0.66	0.72	0.51
Austria	2.49	1.07	1.43	1.10
Belgium	2.90	1.27	1.64	1.24
Canada	1.75	1.00	1.16	0.81
Switzerland	2.10	0.98	1.26	0.98
Czech Republic	1.36	1.05	1.15	0.90
Germany	1.90	0.78	1.11	0.85
Denmark	0.58	0.27	0.33	0.22
Spain	1.62	0.92	1.07	0.81
Finland	1.45	0.59	0.85	0.63
France	1.58	0.62	0.80	0.58
United Kingdom	1.38	0.55	0.70	0.51
Greece	1.63	1.09	1.19	0.84
Hungary	1.00	0.84	0.89	0.64
Italy	1.61	1.16	1.27	0.97
Japan	3.29	1.58	2.02	1.62
Korea	1.76	0.76	1.13	0.88
Mexico	1.51	0.60	0.81	0.61
Netherlands	0.83	0.37	0.46	0.33
Norway	1.78	1.22	1.32	0.69
Poland	3.86	1.82	2.35	1.73
Portugal	1.77	1.33	1.43	1.00
Sweden	0.63	0.31	0.39	0.29
United States	1.32	0.52	0.66	0.49

Industry ISIC Revision 3 in brackets.
* Excluding the farm sector and the mining and quarrying industries. This field corresponds to the sum of the two previous columns.
** The calculations for the whole economy assume that reforms to upstream sectors have no effect on the farm sector, the mining and quarrying industries and the non-business sectors.

[6] Note that we take into account in computing such simulations of the dynamic effect of the interaction between a change in the regulatory burden and in the gap. This effect appears, however, to be rather small.

between actual anti-competitive regulation and best practices in upstream sectors, (ii) the different intensity of downstream intermediate consumption of products from the regulated upstream sectors, (iii) the initial 2010 MFP gaps in the different country-sector pairs and (iv) a composition effect due to the different sector weights in the different countries. The larger the excess regulatory burden and intermediate consumption of regulated products in the relatively more important sectors, the stronger the gains in productivity from aligning regulations in upstream sectors with best international practice; conversely, the smaller the distance to frontier the stronger the gains from deregulation.

Based on these simulation results, the 24 countries considered thus fall into three groups: Denmark, the Netherlands, Sweden and the United States with a relatively smaller impact on average MFP growth of less than 0.5 of a percentage point per year; Austria, Belgium, Japan, Poland and Portugal with a very large impact of more than 1 percentage point per year; the fifteen other countries an intermediate, but still a high one, of between 0.5 and 1 percentage point per year.

Conclusion

We find robust results showing that the expected growth gains from structural reforms that consist of adopting best regulation practices in sectors that are important providers of intermediate inputs to the economy could be important. Nonetheless much more work needs to be done to check the soundness of the policy recommendations that might be drawn from our econometric and simulation results. Although they appear robust, our results should be qualified on at least two grounds. The simulated reforms we consider are of course extremely drastic: adopting the "best practices" in all upstream sectors over a short period (here one year) would be an ambitious and unrealistic task! Anti-competitive regulations on product markets tend to be positively correlated with those on labour markets, as well as negatively correlated with workers' average education and skill levels. It is thus not unlikely that our estimates do not correspond only to the impact of changes on MFP growth in upstream product market regulations, but that they may also reflect the growth impact of other changes in the economic environment, such as a lessening of labour markets regulations and increasing education and skills of the working age population.

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